

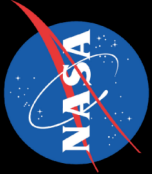
OBPR Product Lines, Human Research Initiative, and Physics Roadmap for Exploration

April 20, 2004

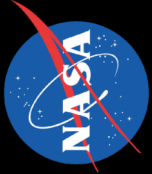
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This research was performed at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration

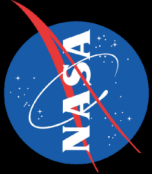


- ***Changes since last year***
- ***OBPR Product Lines***
- ***Human Research Initiative***
- ***Fundamental Physics for Exploration Roadmap***
- ***Conclusions***



Changes since last year

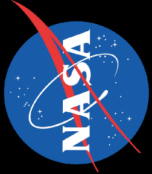
- ***OBPR Implications from President's Exploration Vision***
 - ***OBPR WILL deliver methods and technology to assure human health and performance extra-terrestrially***
 - ***OBPR WILL deliver advanced life-support systems and technology that are reliable, capable, simpler, less massive, smaller, and energy efficient***
 - ***OBPR MAY provide other necessary expertise in areas such as low-gravity behavior***
- ***Focus on products – not research***
- ***No FORMAL direction yet, but..***
 - ***LTMPF and PARCS ISS flight projects slated to terminate in October 2004***
 - ***All flight investigations returned to ground program and phased out by end of FY07***
 - ***Physics ground program intact – for now, but to survive must shift ~ 50% of research to support exploration***
- ***Other disciplines basic research program being cancelled***



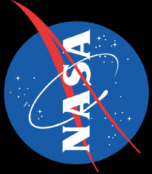
- ***Human Health and Countermeasures***
 - *Guy Fogleman, NASA HQ Point of Contact*

- ***Human Life Support Systems***
 - *Eugene Trinh, NASA HQ Point of Contact*

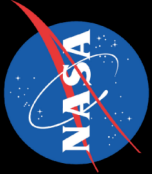
- ***Radiation Protection and Countermeasures***
 - *Terri Lomax, NASA HQ Point of Contact*



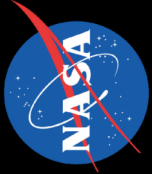
- ***Exercise Systems***
- ***Behavioral Health***
- ***Pharmacology Immunology Nutrition***
- ***Artificial Gravity/Gravity Thresholds***
- ***Technology for Research***
- ***Autonomous Medical Care***
 - *Monitoring*
 - *Prevention*
 - *Diagnosis*
 - *Treatment*



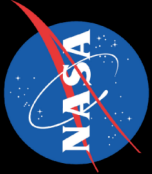
- ***Advanced Life Support (ALS)***
- ***Advanced EVA Systems (AEVA)***
- ***Advanced Environmental Monitoring & Control (AEMC)***
- ***Advanced Food Technology (AFT)***
- ***Space Human Factors***
- ***Fire Prevention, Detection, and Suppression***
- ***In Situ fabrication and Repair***
- ***In Situ Resource Utilization***



- ***Mission & Operations Requirements***
- ***Shielding Solutions***
- ***Risk Assessment & Projection***
- ***Biological Countermeasures***
- ***Measurement Technologies***



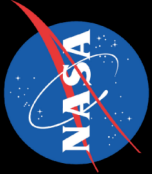
- **Human Health and Countermeasures**
 - *Low-gravity simulators to determine gravity thresholds for biological processes and systems*
 - *Non-invasive medical sensors based on SQUID technology*
 - *Advanced NMR/MRI concepts*
- **Human Life Support Systems**
 - *Remote resource location technology (gravity gradient, magnetic)*
 - *Advanced Sensor technology*
 - *Low-gravity simulators to validate designs for Space, Moon, and Mars fluid systems*
- **Radiation Protection and Countermeasures**
 - *Neutron detectors and other sensors*
 - *Low-gravity simulators to investigate possible interactions between low-gravity effects and radiation damage*
- **Cross-cutting technology**
 - *Clocks, Navigation, and Communication technology*



Human Research Initiative



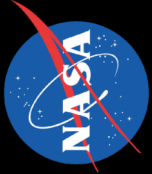
- ***New initiative to fill in perceived funding gaps to ensure human safety and productivity in space.***
- ***Approximately \$90M annually of directed research funding***
- ***Solicitation is limited to NASA centers in the first year***
 - ***Universities must team with JPL or other centers to participate***
- ***Future years solicitations may be more open***
- ***Proposals are solicited at a high summary level with points of contacts identified to work through***
 - ***Funding expected to be in the \$1–10M range***
- ***Solicitation released April 1***
- ***Proposals are due May 15***
- ***Selection process goes through June***
- ***Funding start in October***



Fundamental Physics for Exploration Roadmap

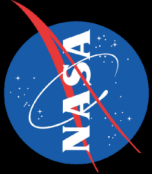


- ***Draft Roadmap discussed at last years PI conference***
- ***Initial Roadmap completed in December 2003. Strong community participation.***
- ***Publication was placed on hold pending rumored changes to a NASA exploration focus.***
- ***Following the President's announcement in January, the Roadmap is undergoing some minor changes to point more clearly to how fundamental physics research can and does support exploration***
- ***JPL will use the new Roadmap to argue for support for fundamental physics research not just to Code U, but to Code S and Code T as well***
 - *We enlist the support of the physics community in this endeavor*



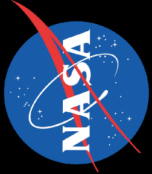
■ Old Roadmap Goals:

1. **Discover new physics beyond today's knowledge of fundamental laws governing matter, space, and time**
 - A. Determine the range of validity of Einstein's relativity theories
 - B. Discover evidence for New Physics beyond the Standard Model
 - C. Find answers to questions of cosmological significance
2. **Understand organizing principles of nature from which structure and complexity emerge**
 - A. Acquire a deeper understanding of organizing principles in condensed matter systems and incorporate in new advanced technologies
 - B. Discover new knowledge about interactions in cold gasses of atoms and incorporate in new advanced technologies
3. **Apply physics results to enable technologies that allow human space exploration far beyond what is possible today**
 - A. Demonstrate benefits of novel physics technologies to solve human space exploration challenges



■ **New Roadmap Goals:**

- 1. Apply physics technologies to solve today's human space exploration challenges**
 - A. Develop physics-based advanced communication and navigation products for Moon, Mars, and beyond
 - B. Develop physics-based advanced resource-location products for human and robotic exploration in the solar system
 - C. Develop physics-based tools for enhanced studies of living systems
- 2. Understand organizing principles of nature from which structure and complexity emerge and apply to tomorrow's exploration needs**
 - A. Acquire a deeper understanding of organizing principles in condensed matter systems and incorporate in exploration technologies
 - B. Discover new knowledge about interactions in cold gasses of atoms and incorporate in exploration technologies
- 3. Discover new physics beyond today's knowledge of fundamental laws governing matter, space, and time to enable exploration far beyond what is possible today**
 - A. Determine the range of validity of Einstein's relativity theories
 - B. Discover evidence for New Physics beyond the Standard Model
 - C. Find answers to questions of cosmological significance



- ***The pace of change has increased at NASA***
- ***OBPR's focus is now on the Human interface as it relates to the new Exploration vision***
- ***The fundamental physics community must demonstrate how we can contribute***
 - *If we do, it is likely that our basic research program will continue*
- ***Many opportunities exist for physicists to participate in addressing NASA's cross-disciplinary exploration challenges***
 - *Physicists can contribute to elucidating basic operating principles for complex biological systems*
 - *Physics technologies can contribute to developing miniature sensors and systems required for manned missions to Mars*
- ***NASA Codes other than OBPR may be viable sources of funding for physics research***